

Claims

1. An antenna structure capable of receiving an external radio signal, said antenna structure comprising a magnetic path that enables reception of magnetic flux caused by an external radio signal, but makes it difficult for magnetic flux generated by resonance to leak to said outside of said antenna structure, said magnetic path being formed minimally by an antenna part, which is formed by at least one antenna core part and a coil part formed by winding of a conductive wire around said antenna core part, and a cover part disposed in a vicinity of said antenna part and covering at least a part of said antenna part, said antenna core part and cover part being made of a soft magnetic material, and also said cover part being joined to said antenna part at both ends of said antenna core part of said antenna part.
- 15 2. An antenna structure according to claim 1, wherein said cover part has a function of passing magnetic flux generated by resonance.
3. An antenna structure according to claim 1 or 2, wherein said cover part is connected via a joining part to said antenna core part of said antenna part.
- 20 4. An antenna structure according to any one of claims 1 to 3, wherein a part of said substantially closed magnetic path formed by said antenna core part and said cover part of said antenna structure includes a part having a permeability that is different from said permeability of other parts.
- 25 5. An antenna structure according to any one of claims 1 to 4, wherein said cover part covers said entire periphery of said antenna part.
6. An antenna structure according to any one of claims 1 to 5, 30 wherein said cover part is formed by a member having a thickness that is thinner than said maximum length of a cross-section of said center part of said antenna core part of said antenna part.

7. An antenna structure according to any one of claims 1 to 4, wherein said cover part has an overall cross-sectional shape that is a one configuration selected from a group consisting L-shaped, channel-shaped (U-shaped), bent shaped, curved shaped, rounded shaped and a closed polygonal shaped configurations or a combination thereof, made from a plate like member or a plurality of said plate like members being integrally assembled to each other.

8. An antenna structure according to any one of claims 1 to 7, wherein said length of said cover part in said longitudinal direction is longer than said length of said coil of said antenna part.

9. An antenna structure according to any one of claims 1 to 8, wherein said angle of intersection formed by two straight lines joining said center of said antenna core part of said antenna part and two ends in said cross-section intersecting with said longitudinal direction of said cover part is at least 90°.

10. An antenna structure according to any one of claims 1 to 9 wherein said cover part is made of either one of a ferrite-based soft magnetic material, a soft magnetic material in which a fine soft magnetic powder of cobalt or cobalt alloy is blended into a resin, or a compound soft magnetic material formed by said lamination of cobalt or cobalt alloy thin films.

11. An antenna structure according to any one of claims 1 to 10, wherein said antenna core part is made of either one of ferrite-based soft magnetic material and a soft magnetic material in which a fine soft magnetic powder of cobalt or cobalt alloy is blended into a resin.

12. An antenna structure according to any one of claims 1 to 11, wherein both end parts of said cover part provided along its longitudinal direction make contact with at least one part of both end parts of said antenna core part of said antenna part.

13. An antenna structure according to claim 12, wherein a support part which supports said cover part is provided on both end parts of said antenna core part in a longitudinal direction thereof.

5 14. An antenna structure according to claim 12, wherein a surface part of said cover part is formed so as to be on one and said same plane with said outermost surface of said antenna core part, or formed at a position lower than said outermost surface of said antenna core part.

10 15. An antenna structure according to claim 13, wherein said support part is a step part formed on a pair of mutually opposing surfaces of both end parts of said antenna core part.

16. An antenna structure according to any one of claims 3 to 15, wherein a magnetic gap of said joining part is either formed via 15 a spacer, adhesive or said like, or formed as an air gap.

17. An antenna structure according to any one of claims 1 to 16, wherein said contacting surface area of said antenna core part in said antenna part to said cover part is larger than said cross-sectional surface area of said cover part.

20 18. An antenna structure according to any one of claims 1 to 17, wherein a collector part that additionally collects magnetic flux of an external radio signal is formed of a soft magnetic material provided on both of said end parts of said antenna core part in said longitudinal direction in said antenna part.

25 19. An antenna structure according to any one of claims 1 to 18, wherein said collector part is integrally formed as one body with said antenna core part on an outer wall part of both end portion of said antenna core part.

20. An antenna structure according to any one of claims 1 to 19, 30 wherein said collector part is formed as a separate item from said antenna core part, and is provided so as to be in contact

with or in proximity to an outer wall part of both ends of said antenna core part.

21. An antenna structure according to any one of claims 1 to 20, wherein said cross-sectional area of said collector part 5 perpendicular to said longitudinal direction thereof is smaller than said cross-sectional area perpendicular to said longitudinal direction of said antenna core part.

22. A radio-controlled timepiece comprising means for generating a reference signal that outputs a reference signal, timekeeping 10 means for outputting timekeeping information based on said reference signal, display means for displaying a time based on said timekeeping information, receiving means for receiving a standard radio signal having standard time information, and a means for correcting said output time information of said 15 timekeeping means based on said received signal from said receiving means, wherein said receiving means includes an antenna structure having a structure as recited in any one of claims 1 to 21.

23. A radio-controlled timepiece according to claim 22, further 20 comprising an outer case made of a metal material.

24. A radio-controlled timepiece according to claim 22, wherein at least one of a side part and a bottom cover part are made of a metal material.